

**NOTES ON *ANACHARIS MELANONEURA*
(HYMENOPTERA: FIGITIDAE) AND
CHARITOPES MELLICORNIS (HYMENOPTERA:
ICHNEUMONIDAE) PARASITIZING *MICROMUS*
POSTICUS (NEUROPTERA: HEMEROBIIDAE)¹**

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ABSTRACT: Laboratory observations were made on the biologies of the figitid, *Anacharis melanoneura*, and the ichneumonid, *Charitopes mellicornis*, parasitizing a brown lacewing, *Micromus posticus*. Mean egg/larval and pupal developmental times of *A. melanoneura* were 11.2 and 6.6 days, respectively, at 28°C. Mean larval and pupal developmental times of *C. mellicornis* were 5.7 and 5.5 days, respectively. The first *C. mellicornis* larva to hatch killed, but did not consume, the remaining eggs in the clutch and then fed upon the *M. posticus* larva.

The brown lacewing, *Micromus posticus* (Walker), is a common, aphidophagous predator occurring throughout the eastern United States. Its use as a biological control agent has been proposed because of its potential for rapid population growth (Miller and Cave 1987). However, population growth could be slowed in the field by the predator's own natural enemies. The ichneumonid *Charitopes mellicornis* (Ashmead) is the only species listed as parasitizing *M. posticus* (Carlson 1979). Selhime and Kanavel (1968) reported a species of the figitid genus *Anacharis* attacking *Micromus subanticus* (Walker), but not *M. posticus*, in Florida and provided brief notes on the parasitoid's biology. In an unsprayed cotton field in Alabama, Miller and Cave (1987) found 6% of the *M. posticus* cocoons were parasitized by *C. mellicornis* and *Anacharis melanoneura* Ashmead.

Anacharis melanoneura ranges from Virginia to Florida and west to Louisiana and Texas (Burks 1979). Our collection of this species is the first record in Alabama. According to Burks (1979), it is the only known *Anacharis* species in the southeastern United States. The only other reported host for *A. melanoneura* is *Hemerobius stigma* Stephens (Miller and Lambdin 1985). However, the *Anacharis* sp. found attacking *M. subanticus* by Selhime and Kanavel (1968) may have been *A. melanoneura* since no other species of *Anacharis* are known in the region. Miller and Lambdin (1985) illustrated the larval, pupal, and adult stages of *A. melanoneura*.

The known distribution of *C. mellicornis* is from Massachusetts to South Carolina and west to Minnesota and Iowa (Carlson 1979). Our collection of

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this parasitoid in Alabama is a new state record and extends the southern range of the species. Only three other species of *Charitopes* are known from North America, none of which is apparently sympatric with *C. mellicornis* (Carlson 1979). No other hosts besides *M. posticus* have been listed in the literature for *C. mellicornis*. However, species of *Charitopes* in the western United States are known to attack *Hemerobius* spp. (Deyrup and Deyrup 1978). The adult female of *C. mellicornis* was illustrated by Townes (1969).

The purpose of this paper is to report laboratory observations on the biologies of *A. melanoneura* and *C. mellicornis* parasitizing *M. posticus*.

METHODS AND MATERIALS

Eggs and larvae of *M. posticus* were collected from an unsprayed cotton field in Elmore Co., AL, in August, 1984 and reared in the laboratory with cotton aphids, *Aphis gossypii* Glover, as prey. Larvae and pupae of *C. mellicornis* and *A. melanoneura* were collected in the same field during the first week of September. Field-collected hosts parasitized by either of the two parasitoids were placed individually in plastic cups (30 ml) with a moistened cotton ball and held at 28°C, ca. 70% RH, and 14:10 L:D photoperiod. As female parasitoids emerged, they were placed individually in cups with conspecific males and suitable hosts. A drop of 10% honey water was placed on the inside of each cup as a food source for the adult parasitoids.

First-, second-, and active third-instar *M. posticus* larvae were exposed to *A. melanoneura* for 24 h. After exposure, larvae were placed singly in cups with cotton aphids and allowed to develop. Fresh hosts were given to the adult parasitoids until they died. Exposed hosts were observed daily for parasitoid emergence.

Charitopes mellicornis adult females were provided 1-5 quiescent third-instar larvae or < 1-day-old pupae of *M. posticus*. Preliminary experiments revealed that females did not oviposit on active larvae. Oviposition behavior of females was observed during the day with a dissecting microscope. Parasitized hosts were replaced with fresh, unparasitized ones daily. The number of eggs laid daily was recorded. Parasitized hosts were placed individually in cups containing a moistened cotton ball and observed daily for parasitoid egg hatch and larval development.

Parasitoids and *M. posticus* were identified by the authors. Original descriptions (Ashmead 1887, 1889), Townes (1969), Burks (1979), Carlson (1979), and Miller and Lambdin (1985) were consulted in determining the parasitoid species. Voucher specimens are deposited in the Entomology Collection of Auburn University and in the collection of the senior author.

RESULTS AND DISCUSSION

Anacharis melanoneura attacked only second- and early third-instar *M. posticus*. Miller and Lambdin (1985) noted that *A. melanoneura* oviposited only in late second- and third-instar *H. stigma* and either ignored or simply palpated first-instars. Selhime and Kanavel (1968) stated, however, that first-instar *M. subanticus* were successfully parasitized by the *Anacharis* sp. they studied.

Egg incubation and larval development of *A. melanoneura* within the host together lasted 7-8 days ($\bar{x}=7.5$, $n=4$). During this time, the host larvae developed and spun cocoons but did not transform to pupae. After feeding internally, the parasitoid larvae emerged through the ventral integument between opposing legs of the host. Only one larval *A. melanoneura* emerged per host. After emergence, the third-instar parasitoids continued to feed until their hosts' cadavers were entirely consumed. This period of external feeding and development lasted 2-5 days ($\bar{x}=3.7$, $n=6$). Larvae then pupated without forming cocoons and remained as pupae for 5-8 days ($\bar{x}=6.6$, $n=9$). These larval developmental times are similar to those observed by Miller and Lambdin (1985) for *A. melanoneura* parasitizing *H. stigma*, although the temperature to which they subjected their organisms was 6-8°C cooler than ours. Pupal developmental time was slightly shorter in our study.

Adult *A. melanoneura* remained inside the host's cocoon for 24 h, then emerged to feed on the honey water solution. Longevity of the reared adults was 1-9 days ($\bar{x}=4.9$, $n=7$).

Female *C. mellicornis* deposited their eggs on quiescent third-instar hosts except for one instance when eggs were laid on a 1-day-old pupa. During oviposition, the female inserted her ovipositor through the host's two-layered cocoon and maneuvered the ovipositor until the tip made contact with the host. Upon contact, she attached 1-9 eggs ($\bar{x}=4.1$, $n=11$) to the host's integument. All the females we observed deposited their eggs during a single period on a host and did not return to parasitized hosts later on to lay more eggs. Newly laid eggs are pearly white and 0.76 mm long by 0.18 mm wide (Fig. 1A). Although as many as five suitable hosts were concurrently available, female parasitoids always laid their eggs of any given day in just one host cocoon, except for one instance in which two cocoons received 1 and 4 eggs each from a single female in a 24 h period.

Egg hatch occurred in 24 h. The first-instar larva is 0.64 mm long and the conspicuous head capsule has a pair of prominent, conical antennae (Fig. 1B). A band of grey setae encircles each segment. Immediately after eclosion, the first emergent larva killed, but did not consume, the unhatched eggs and then began to feed externally on the *M. posticus* larva. The eggs destroyed by the first emergent larva were not necessarily inviable. We

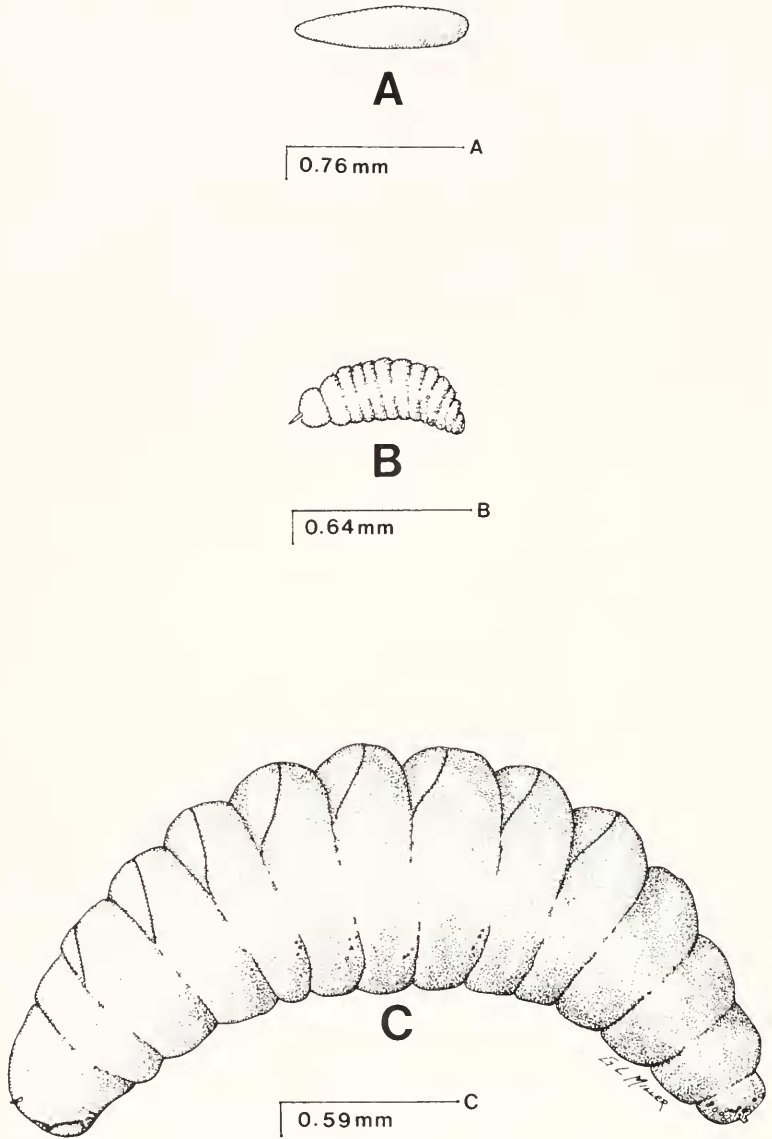


Fig. 1. *Charitopes mellicornis*. A. Egg; B. First-instar larva; C. Third-instar larva.

divided a clutch of 8 eggs into two groups of two and six eggs each and placed the groups on separate hosts. The first egg to hatch in each group destroyed the rest of the eggs in its respective group and then began to feed on the *M. posticus* larva. We also separated two eggs of another clutch and both eggs subsequently hatched. We observed this fratricidal behavior in every case ($n=8$) in which two or more eggs were laid on the same host. The first larva to emerge apparently benefits from this fratricidal behavior by having more food resource available to it. However, by depositing all their eggs on one host and all but one egg being subsequently destroyed, females appeared to be wasting eggs, especially since other suitable hosts were available. It is not known if superparasitism by this species occurs in the field. We never found more than one *C. mellicornis* larva or pupa within a host cocoon in the field. Nevertheless, superparasitism by *C. mellicornis* may be a laboratory artifact caused by the restriction of females to small arenas. Thus, the phenomena of superparasitism and fratricidal behavior by this parasitoid need to be investigated further.

Developmental time for larval *C. mellicornis* was 5-7 days ($\bar{x}=5.7$, $n=9$). This period included 2-3 days spent spinning a silken white cocoon within the host's cocoon. Thus, the larva fed on the host for only 3-4 days. Third-instar larvae are 14-segmented and 2.60 mm long (Fig. 1C). The integument is finely scabrous with a few setae and rounded protuberances on each segment. Many of these protuberances are clustered around the last abdominal segment. Compared to the first-instar, the head capsule is indistinct and the antennae are greatly reduced. Unlike *A. melanoneura*, *C. mellicornis* did not consume the entire host, but left the shriveled integument after consuming all the body fluids.

The pupal stage of *C. mellicornis* lasted 4-10 days ($\bar{x}=5.5$, $n=11$), after which the adult chewed an emergence hole through both cocoons. Adults lived as long as 14 days. Mating was not observed and the progeny of all females (reared from field-collected specimens) were all males.

The parasitoid fauna of Nearctic Hemerobiidae continues to be overlooked, although parasitoids may limit the effectiveness of these predators (Cole 1933). Parasitism of immature brown lacewings may be as low as 5% (Deyrup and Deyrup 1978) or as high as 60% (Selhime and Kanavel 1968). Biological control programs that take advantage of brown lacewings as aphid predators should therefore examine the role that parasitoids play in the population dynamics of these predators.

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